尿石症の超音波診断法

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ULTRASONIC DIAGNOSIS OF UROLITHIASIS

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INTRODUCTION

Since about twenty years ago, ultrasonic methods have been used for the detection of submarines, fish finding and flaw detection of metal. Now, ultrasonics have been applied to medical purpose. Recently, many reports on ultrasonic diagnosis have been published, but only a few reports (Schlegel, Takahashi, Gotoh etc.) have appeared in the field of urology. This paper deals with results of our experience on the ultrasonic diagnosis of urolithiasis.

ULTRASONIC APPARATUS

The ultrasonic apparatus used by the authors was a portable Aloka SSD-2B which was designed for A-scope indication (Japan Radio Co.). The A-scope indication is to display the ultrasonic echoes as wave forms.

PRELIMINARY TEST

The thickness of the test piece, a specific plastic block, is made equivalent to 5 cm of human body. The ultrasonic echoes were obtaind from the surface, bottom, and slit of the block of the piece by putting the probe on it ; then the depth was determined.

PRELIMINARY EXAMINATION

First of all, the ultrasonic echoes which were reflected from a stone hanging into the water in the glass were scanned. It is already known that the speed of spread of ultrasonic waves in the human body is almost equal to that in the water. Depths from the water surface both to the stone and to the bottom of the glass were measured by scanning the echoes which were reflected from the water surface, the stone and the bottom of the glass respectively.

The ultrasonic apparatus was set up to scan the stone hanging in the water under the following conditions which will be described later for scanning kidney.

Five different sized stones were used for this purpose (Fig. 1). In general, the smaller stone reflected the smaller echo (Fig. 2～5), but the smallest stone (E : 0.3 cm×0.2 cm×0.2 cm) did not reflected any echoes (Fig. 6).

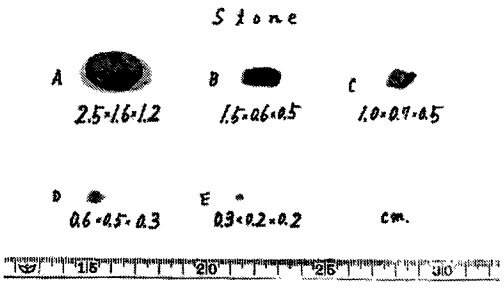

Fig. 1. These stones were used for taking ultrasono-echograms by hanging in water.

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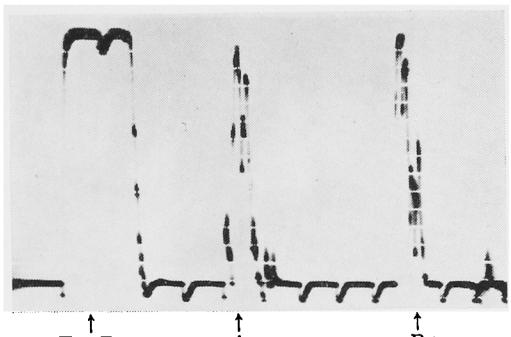

Fig. 2. Ultrasono-echogram of Stone (A) Hanging in Water.

T. P ..... Transmitted Pulse
A ..... Stone Echo
B ..... Bottom Echo

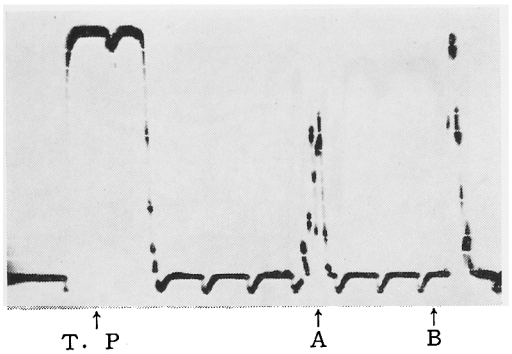

Fig. 3. Ultrasono-echogram of Stone (B) Hanging in Water.

T. P. ..... Transmitted Pulse
A ..... Stone Echo
B ..... Bottom Echo

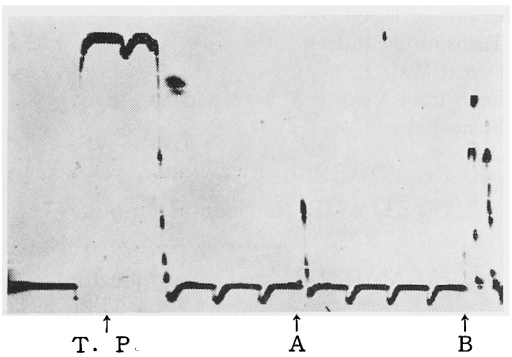

Fig. 4. Ultrasono-echogram of Stone (C) Hanging in Water.

T. P. ..... Transmitted Pulse
A ..... Stone Echo
B ..... Bottom Echo

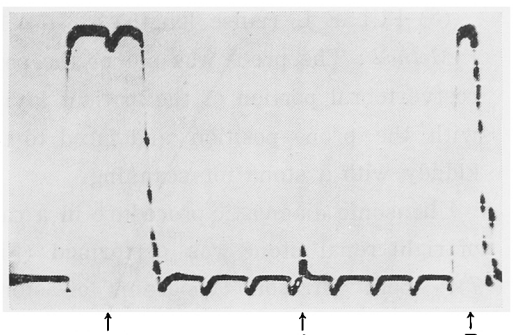

Fig. 5. Ultrasono-echogram of Stone (D) Hanging in Water.

T. P ..... Transmitted Pulse
A ..... Stone Echo
B ..... Bottom Echo

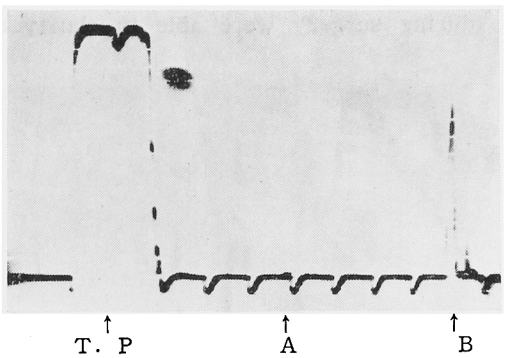

Fig. 6. Ultrasono-echogram of Stone (E) Hanging in Water.

T. P ..... Transmitted Pulse
A ..... Nonvisual Stone Echo
B ..... Bottom Echo

ULTRASONIC DIAGNOSIS OF RENAL STONE

The ultrasonic apparatus to scan the kidney was set up under the following conditions :

(1) FREQ (impulse frequency)···2.25 MC
(2) PULSE RATE ..... 500 C/S
(3) POWER ..... 100 V
(4) H. AMP (horizontal amplifier)
.....constant
(5) MARKER (marker generator)
.....constant
(6) GAIN (gain of receiving amplifier)
.....8
(7) REJECTION.....10

(8) PULSE L (pulse length) 1.0

Method : The probe was put on the post-costvertebral portion of the patient laying with the prone position and faced to the kidney with a stone for scanning.

Ultrasonic diagnostic procedure in a case of right renal stone was performed (Fig. 7). Both ultrasono-echograms of stone-side (right kidney) and of no-stone-side (left kidney) were obtained and the stone echo was clearly displaied in the right kidney (Fig. 8).

Ultrasonic examinations anticipated to scan the exposed kidney with a stone during surgery were able to clarify the localization of the stone, and thus made the stone to remove easily (Fig. 9).

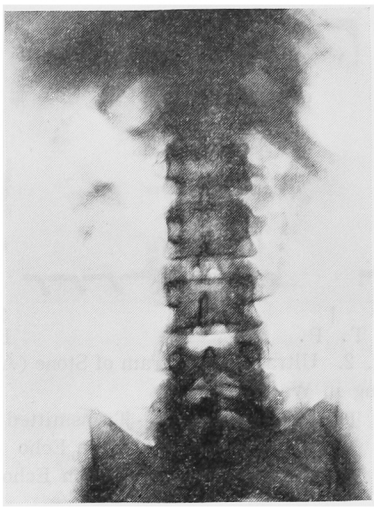

Fig. 7. The Plain Eilm Shows a Right Renal Stone.

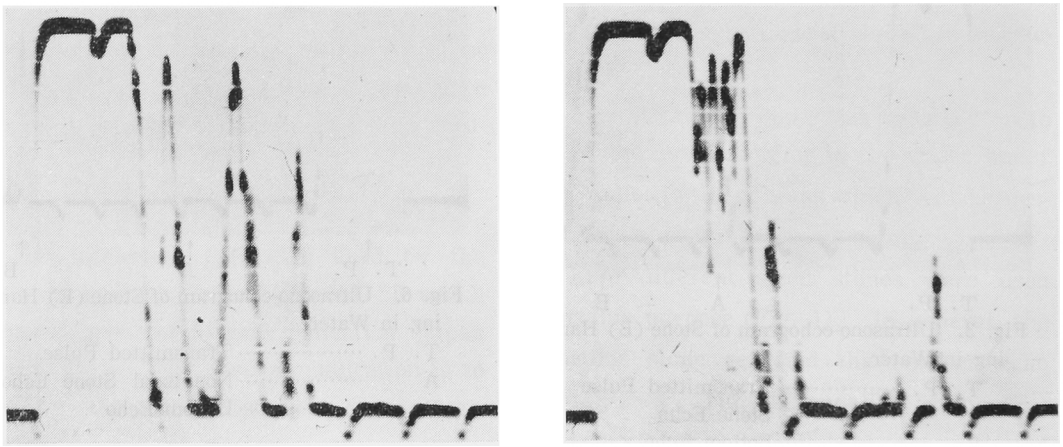

Fig. 8. Ultrasono-echograms of Renal Stone.

T. P. ..... Transmitted Pulse
A_1 ..... Dorsal Wall Echo
A_2 ..... Echo from Ventral Side of Kidney
B ..... Stone Echo

ULTRASONIC DIAGNOSIS OF PROSTATIC STONE

The ultrasonic apparatus to scan the prostate was set up under the following conditions :

(1) FREQ (impulse frequency).....5 MC
(2) PULSE RATE ..... 500 C/S
(3) POWER ..... 100 V
(4) H. AMP (horizontal amplifier) .....constant
(5) MARKER (marker generator) .....constant
(6) GAIN (gain of receiving amplifier) 10
(7) REJECTION 10
PULSE L (pulse length).....1.0 or 2.0

Transrectal method

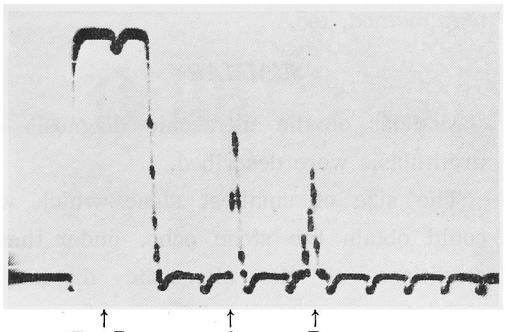

Fig. 9. Ultrasono-echogram of Exposed Kidney with Stone.

T. P ..... Transmitted Pulse
A ..... Stone Echo
B ..... Backside Echo of Kidney

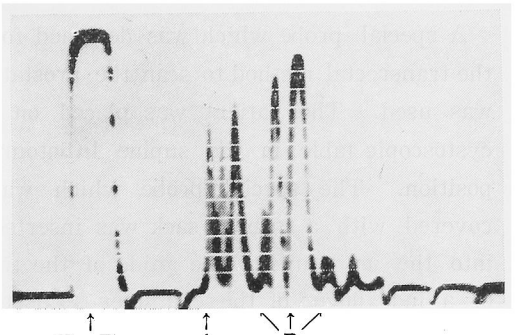

Fig. 12. Ultrasono-echogram of Prostatic Stones.

T. P ..... Transmitted Pulse
A ..... Rubber Echo
B ..... Stone Echo

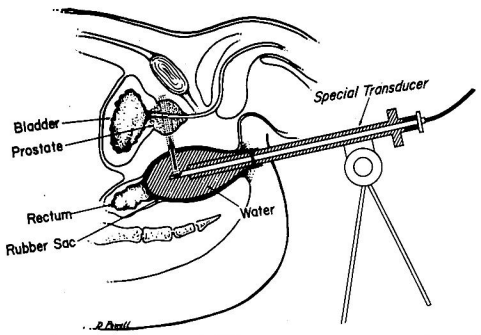

Fig. 10. Scheme of Ultrasonic Examination of Prostate by Transrectal Method.

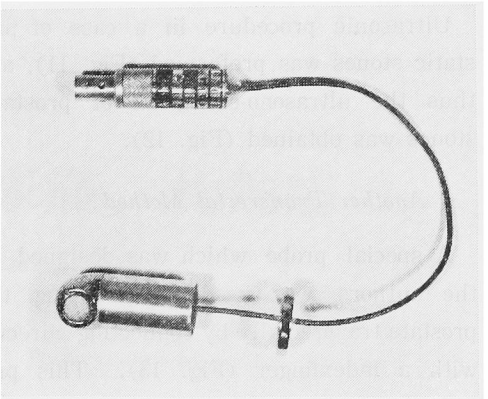

Fig. 13. Special Probe for Connection with a Finger by Another Transrectal Method.

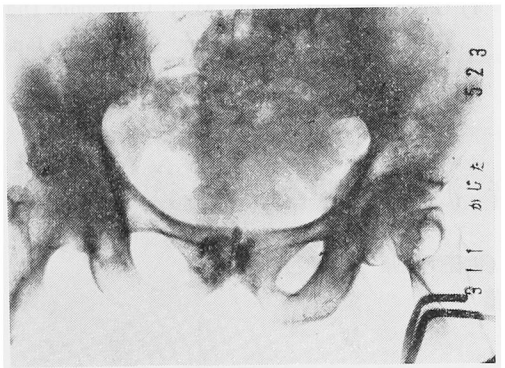

Fig. 11. The Plain Film Demonstrates Prostatic Stones.

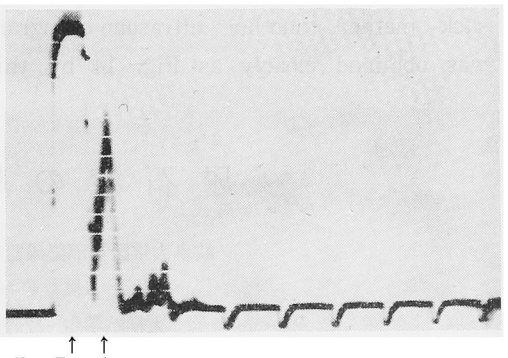

Fig. 14. Ultrasono-echogram of Prostatic Stone.

T. P ..... Transmitted Pulse
A ..... Stone Echo

A special probe which was designed for the transrectal method to scan the prostate was used. The patient was placed on a cystoscopic table in the supine lithotomy position. The special probe which was covered with a rubber sack was inserted into the anus under the guide of the tip of a indexfinger of the examiner so as to be in contact directly with the rectal mucosa in the region of the prostate. Then the sack was filled with 200 to 300 ml of water without mixing air (Fig. 10). After this procedure, the echoes which were reflected from the prostate could be scanned.

Ultrasonic procedure in a case of prostatic stones was preformed (Fig. 11), and thus the ultrasono-echogram of prostatic stones was obtained (Fig. 12).

Another Transrectal Method

A special probe which was designed by the authors was used for scanning the prostate transrectally by connecting directly with a indexfinger (Fig. 13). This procedure was more simple and easier than the former.

In the same case of prostatic stones which were examined before the rubber sack method, another ultrasono-echogram was obtained clearly as Fig. 14 by this new method, too.

SUMMARY

Methods of the ultrasonic diagnosis of urolithiasis were described.

The size of smallest stone which we could obtain the stone echo, under these conditions of the ultrasonic diagnostic apparatus, was 0.6 cm×0.5 cm×0.3 cm.

Although the method is not capable of substituting the roentgenography, it is very simple and safe and also have some advantage to determine the depth of localization of stone.

This study was presented before the Czechoslovak Congress of Urology with International Participation held in Brno-ČSSR from May 12 th to 14 th, 1966.

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尿石症の超音波診断法

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尿石症の超音波診断法について述べた．

本論文の要旨は1966年5月12～15日チエッコスロヴァキヤ国 ブルノ市にて開催の 国際泌尿器科学会のシンポジァム「尿石症」に発表した．
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